AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method comprising:

creating a plurality of separate service levels by applying a set of one or more connectivity constraints that include quality of service (QoS) based criteria on a physical network topology of a wave length division multiplexing optical network to divide said optical network into said plurality of separate service levels, wherein the connectivity constraints are based on a conversion criteria;

determining service level topologies for each of said plurality of separate service levels for each of a plurality of access nodes in the optical network, wherein each service level topology is a network topology that includes a smaller number of end to end paths ~~smaller~~ than an entire network topology of the optical network and said each service level topology comprises end to end paths satisfying the corresponding service level from that access node to all other reachable access nodes in said optical network as destinations, wherein an end to end path between two access nodes is the set of ~~one~~ two or more links and available wavelengths on that end to end path between the two access nodes, wherein allocated and unallocated wavelengths are considered available wavelengths; and

storing the plurality of service level topologies in a service level connectivity database for each access node and on that access node, wherein the service level connectivity database includes a service level topology structure for each of the plurality of service level topologies and each service level topology structure references the end to end paths for that access node satisfying the corresponding service level, wherein each of the set of end to end paths for that service level references a set of links satisfying that service level on that possible end to end path, wherein the set of links

references available wavelengths for that possible end to end path satisfying that service level.

2. (Original) The method of claim 1, wherein said QoS based criteria includes one or more of bandwidth, bit error rate, optical signal to noise ration, peak noise level, and re-routing priority.

3. (Original) The method of claim 1, wherein said determining includes determining, for each service level, a service level topology for the network.

4. (Cancelled)

5. (Original) The method of claim 1, wherein said set of connectivity constraints also includes a set of one or more conversion criteria.

6. (Original) The method of claim 1, wherein said set of connectivity constraints also includes a conversion free connectivity constraint.

7. (Currently Amended) A method comprising:

maintaining in each node of a wave length division multiplexing optical network a classification by QoS criteria of wavelengths for each link of the wave length division multiplexing optical network, said QoS criteria defining a plurality of service levels;

for each of said plurality of service levels, maintaining a service level topology from each node to other nodes of the wave length division multiplexing optical network based on a conversion criteria, wherein each service level topology is a network topology that includes a smaller number of end to

end paths ~~smaller~~ than an entire network topology of the optical network and said each service level topology comprises end to end paths satisfying the corresponding service level from that node to all other reachable nodes in said optical network as destinations, wherein an end to end path between two nodes is the set of ~~one~~ two or more links and available wavelengths on that end to end path between the two nodes, wherein allocated and unallocated wavelengths are considered available wavelengths; and

updating the plurality of maintained service level topologies in a service level database for each node and on that node, wherein the service level connectivity database includes a service level topology structure for each of the plurality of service level topologies and each service level topology structure references a set of end to end paths satisfying the corresponding service level, wherein each of the set of end to end paths for that service level references a set of links satisfying that service level on that possible end to end path, wherein the set of links references available wavelengths for that possible end to end path satisfying that service level.

8. (Original) The method of claim 7, wherein said QoS based criteria includes one or more of bandwidth, bit error rate, optical signal to noise ration, peak noise level, and re-routing priority.

9. (Original) The method of claim 7, further comprising:

tracking said wavelengths for each of said links by operating a link management protocol in each of the nodes of the optical network.

10. (Original) The method of claim 7, wherein said maintaining said classification includes comparing parameters of each of the wavelengths to service level parameters, wherein there is a service level parameter for each of said plurality of service levels for each of said QoS criteria.

11. (Original) The method of claim 10, wherein said maintaining said classification includes each node of said optical network performing said comparing.

12. (Canceled)

13. (Previously Presented) The method of claim 7, wherein said conversion criteria represents the number of wavelength conversion-s allowable for a given optical circuit.

14. (Currently Amended) An apparatus comprising:

a wavelength division multiplexing optical network supporting a plurality of service levels, wherein different wavelengths on at least certain links of said optical network qualify for different ones of said plurality of service levels; and

at least one separate network topology database for each of said plurality of service levels that represents end to end paths between access nodes of said optical network using those of the wavelengths that qualify for that service level, wherein each access node of said optical network stores a separate one of said network topology databases for each of said plurality of service levels, and wherein each service level topology is a network topology that includes a smaller number of end to end pathss~~maller~~ than an entire network topology of the optical network and said each separate network topology database stores a set of end to end paths satisfying the

corresponding service level from that access node to all other reachable access nodes in said optical network as destinations, wherein an end to end path between two access nodes is the set of ~~one~~ two or more links and available wavelengths on that end to end path between the two access nodes, wherein allocated and unallocated wavelengths are considered available wavelengths, wherein each of the set of end to end paths for that service level references a set of links satisfying that service level on that possible end to end path, wherein the set of links references available wavelengths for that possible end to end path satisfying that service level, wherein the separate network topology databases are based on a conversion criteria.

15. (Original) The apparatus of claim 14, wherein the connectivity is conversion free connectivity.

16. (Original) The apparatus of claim 14, wherein said network topology databases are stored in a centralized network server.

17. (Cancelled)

18. (Currently Amended) An apparatus comprising:

for each available wavelength on each link of a wavelength division multiplexing optical network, a wavelength parameter for each of a set of QoS based criteria, wherein allocated and unallocated wavelengths are considered available;

for each of a plurality of service levels, a service level parameter for each of said set of QoS based criteria;

for each link of said optical network, a link service level channel set for each of said plurality of service levels representing those of the available wavelengths on that link with parameters meeting the service level parameters of that service level; and

for each access node of said optical network, a service level topology structure based on a conversion criteria for each of said plurality of service levels representing end to end paths of that access node to all other access nodes using wavelengths from the link service level channel sets of that service level, wherein each access node stores those of said service level topology structures, and wherein said topology structures is that includes a smaller number of end to end paths ~~smaller~~ than an entire network topology of said optical network.

19. (Original) The apparatus of claim 18, wherein said QoS based criteria includes one or more of bandwidth, bit error rate, optical signal to noise ration, peak noise level, and re-routing priority.

20. (Original) The apparatus of claim 18, wherein each access node of said optical network stores the link service level channel sets of those of the links connected to that access node.

21. (Original) The apparatus of claim 18, wherein said service level topology structures are stored in a centralized network server.

22. (Cancelled)

23. (Original) The apparatus of claim 18, wherein each of said service level topology structures stores those paths for which the intersection of the link service level channel sets of the links of that path is not null.

24. (Currently Amended) An apparatus comprising:

an access node, to be coupled in a wavelength division multiplexing optical network, including,

a link state database to store, for each link connected to said access node, a link state structure to store a port of the access node to which that link is connected, available wavelengths on that link, and parameters of those wavelengths;

a service level parameter database to store, for each of a set of one or more supported service levels, a service level parameter for each of a set of QoS based criteria; and

a service level connectivity database to store, for each of said set of service levels, a service level topology structure based on a conversion criteria that stores a representation of the service level topology of that service level for said access node, wherein the service level topology is that includes a smaller number of end to end paths ~~smaller~~ than an entire network topology of said optical network, and wherein each of the service level topology structure references a set of end to end paths satisfying the corresponding service level, wherein each end to end path wherein an end to end path between two access nodes is the set of ~~one~~ two or more links and available wavelengths on that end to end path between the two access nodes, wherein allocated and unallocated wavelengths are considered available wavelengths, wherein each of the set of end to

end paths for that service level references a set of links satisfying that service level on that possible end to end path, wherein the set of links references available wavelengths for that possible end to end path satisfying that service level.

25. (Original) The apparatus of claim 24, wherein said QoS based criteria includes one or more of bandwidth, bit error rate, optical signal to noise ration, peak noise level, and re-routing priority.

26. (Original) The apparatus of claim 24, wherein each of said service level topology structures stores paths to those of other access nodes of said optical network that can be reached with those of said wavelengths that qualify for the service level of that service level topology structure.

27. (Original) The apparatus of claim 24, wherein each of said service level topology structures stores available paths to other access nodes in said optical network.

28. (Canceled)

29. (Canceled)

30. (Original) The apparatus of claim 24, wherein said access nodes also includes a set of one or more modules to, responsive to request to change the service level of a given provisioned service, allocate a new communication path at a different one of the service levels than a previous communication path, begin routing traffic of the service on the new communication path, and deallocate the previous communication path.

31. (Currently Amended) A method for an access node of a wavelength division multiplexing optical network, said method comprising:

for each link to an adjacent node of said wavelength division multiplexing optical network, said access node classifying wavelengths on that link according to a set of one or more service level parameters for each of a plurality of service levels;

for each of said plurality of service levels, instantiate a service level topology structure based on a conversion criteria, wherein each service level topology is a network topology that includes a smaller number of end to end paths ~~smaller~~ than an entire network topology of the optical network, and wherein the service level topology structure references a set of end to end paths satisfying the corresponding service level, wherein each end to end path wherein an end to end path between two access nodes is the set of ~~one~~ two or more links and available wavelengths on that end to end path between the two access nodes, wherein allocated and unallocated wavelengths are considered available wavelengths, wherein each of the set of end to end paths for that service level references a set of links satisfying that service level on that possible end to end path, wherein the set of links references available wavelengths for that possible end to end path satisfying that service level; and

responsive to receiving information regarding connectivity at each of said plurality of service levels to other access nodes in said optical network, adding such information to said service level topology structure for that service level.

32. (Original) The method of claim 31, wherein said classifying is based on one or more of bandwidth, bit error rate, optical signal to noise ration, peak noise level, and re-routing priority.

33. (Previously Presented) The method of claim 31, further comprising:

for each link to an adjacent node, tracking said available wavelengths by operating a link management protocol.

34. (Previously Presented) The method of claim 31, wherein said classifying includes comparing parameters of each of the available wavelengths to the sets of service level parameters.

35. (Previously Presented) The method of claim 31, wherein said adding includes, for each of said service level topology structures, storing paths to those of other access nodes of said optical network that can be reached with those of said available wavelengths that qualify for the service level of that service level topology structure.

36. (Previously Presented) The method of claim 35, wherein each of said paths is a series of two or more nodes connected by links on which there are available wavelengths at the service level of that path.

37. (Currently Amended) A machine-readable storage medium that provides instructions that, if executed by a processor, will cause said processor to perform operations comprising:

for each link to an adjacent node of a wavelength division multiplexing optical network, classifying wavelengths on that link according to a set of one or more service level parameters for each of a plurality of service levels;

for each of said plurality of service levels, instantiate a service level topology structure, based on a conversion criteria wherein each service level topology is a network topology that includes a smaller number of end to end paths ~~smaller~~ than an entire network topology of the optical network, and wherein the service level topology structure references a set of end to end paths satisfying the corresponding service level, wherein each end to end path, wherein an end to end path between two access nodes is the set of ~~one~~ two or more links and available wavelengths on that end to end path between the two access nodes, wherein allocated and unallocated wavelengths are considered available wavelengths, wherein each of the set of end to end paths for that service level references a set of links satisfying that service level on that possible end to end path, wherein the set of links references available wavelengths for that possible end to end path satisfying that service level; and

responsive to receiving information regarding connectivity at each of said plurality of service levels to other access nodes in said optical network, adding such information to said service level topology structure for that service level.

38. (Previously Presented) The machine-readable storage medium of claim 37, wherein said classifying is based on one or more of bandwidth, bit error rate, optical signal to noise ration, peak noise level, and re-routing priority.

39. (Previously Presented) The machine-readable storage medium of claim 37, the operations further comprising:

for each link to an adjacent node, tracking said available wavelengths by operating a link management protocol.

40. (Previously Presented) The machine-readable storage medium of claim 37, wherein said classifying includes comparing parameters of each of the available wavelengths to the sets of service level parameters.

41. (Previously Presented) The machine-readable storage medium of claim 37, wherein said adding includes, for each of said service level topology structures, storing paths to those of other access nodes of said optical network that can be reached with those of said available wavelengths that qualify for the service level of that service level topology structure.

42. (Previously Presented) The machine-readable storage medium of claim 41, wherein each of said paths is a series of two or more nodes connected by links on which there are available wavelengths at the service level of that path.

43. (Currently Amended) A method comprising:

establishing a plurality of different service level topologies for a source node of an wavelength division multiplexing optical network in separate service level topology structures, wherein each of the plurality of different service level topologies references a set of ~~communication~~ paths satisfying the corresponding service level, wherein each of the set of ~~communication~~ paths for that service level references a set of links satisfying that service level on that ~~communication~~ path, wherein the set of links references available wavelengths for that ~~communication~~ path satisfying that service level, wherein a ~~communication~~ path between two access nodes is the set of ~~one~~ two or more links and available wavelengths on that

~~communication~~ path between the two access nodes, wherein allocated and unallocated wavelengths are considered available wavelengths;

receiving a request for a communication path starting at the source node in said optical network;

selecting a first of a plurality of service level corresponding to one of the plurality of different service level topologies, wherein the different service level topology is a network topology that includes a smaller number of paths ~~smaller~~ than an entire network topology of the optical network and wherein the different service level topology is based on a conversion criteria;

selecting one of the ~~communication~~ paths and a wavelength on that path using a database that stores, for each of the plurality of service levels, the separate service level topology structures; and

causing allocation of the selected wavelength in the series of nodes of the selected path.

44. (Original) The method of claim 43, wherein said communication path is a lightpath.

45. (Original) The method of claim 43, wherein said communication path is an optical circuit.

46. (Original) The method of claim 43, wherein said selecting said path and said allocation is performed in real time.

47. (Canceled)

48. (Canceled)

49. (Original) The method of claim 43, wherein said database stores, for each of the plurality of service levels, a representation of available conversion free paths from the source node to other access nodes in said optical network.

50. (Currently Amended) A machine-readable storage medium that provides instructions that, if executed by a processor, will cause said processor to perform operations comprising:

establishing a plurality of different service level topologies for a source node of an wavelength division multiplexing optical network in separate service level topology structures, wherein each of the plurality of different service level topology references a set of ~~communication~~ paths satisfying the corresponding service level, wherein each of the set of ~~communication~~ paths for that service level references a set of links satisfying that service level on that ~~communication~~ path, wherein the set of links references available wavelengths for that ~~communication~~ path satisfying that service level, wherein a ~~communication~~ path between two access nodes is the set of ~~one~~ two or more links and available wavelengths on that communication path between the two access nodes, wherein allocated and unallocated wavelengths are considered available wavelengths;

responsive to receiving a request for a communication path starting at the source node in said optical network, selecting a first of a plurality of service levels corresponding to one of the plurality of different service level topologies~~,~~;

selecting one of the ~~communication~~ paths and a wavelength on that path using a database that stores, for each of the plurality of service levels, the separate

service level topology structures,~~,~~ and wherein said separate service topology structures ~~are~~ include a smaller number of paths ~~smaller~~ than an entire network topology of said optical network; and

causing allocation of the selected wavelength in the series of nodes of the selected path.

51. (Previously Presented) The machine-readable storage medium of claim 50, wherein said communication path is a lightpath.

52. (Previously Presented) The machine-readable storage medium of claim 50, wherein said communication path is an optical circuit.

53. (Previously Presented) The machine-readable storage medium of claim 50, wherein said selecting said path and said allocation is performed in real time.

54. (Canceled)

55. (Canceled)

56. (Original) The machine-readable storage medium of claim 50, wherein said database stores, for each of the plurality of service levels, a representation of available conversion free paths from the source node to other access nodes in said optical network.

57. (Currently Amended) A method comprising:

establishing different service level topologies for a source node of an wavelength division multiplexing optical network in separate service level topology structures, wherein each separate service level topology references a set of

communication paths satisfying the corresponding service level, wherein each of the set of ~~communication~~ paths for that service level references a set of links satisfying that service level on that ~~communication~~ path, wherein the set of links references available wavelengths for that ~~communication~~ path satisfying that service level, wherein a ~~communication~~ path between two access nodes is the set of ~~one~~ two or more links and available wavelengths on that ~~communication~~ path between the two access nodes, wherein allocated and unallocated wavelengths are considered available wavelengths;

receiving a request to change a service provisioned with a communication path established in said optical network at one of a plurality of service levels to a different one of said plurality of service levels, ~~,~~ and wherein said different service level topology is based on a conversion criteria;

selecting one of the ~~communication~~ paths and a wavelength on that path using a database that stores, for each of the plurality of service levels, the separate service level topology structures, wherein said separate service topology structure ~~is~~ includes a smaller number of paths ~~smaller~~ than an entire network topology of said optical network;

causing allocation of the selected wavelength in the series of nodes of the selected path to form a new communication path; and

transitioning said service to the new communication path.

58. (Original) The method of claim 57, wherein said communication path is a lightpath.

59. (Original) The method of claim 57, wherein said communication path is an optical circuit.

60. (Original) The method of claim 57, wherein said selecting said path and said allocation is performed in real time.

61. (Cancelled)

62. (Original) The method of claim 57, wherein said database stores, for each of the plurality of service levels, a representation of available conversion free paths from the source node of said communication path to other access nodes in said optical network.

63. (Original) The method of claim 57, wherein said transitioning includes:

moving traffic from the previous communication path to the new communication path; and

deallocating the previous communication path.

64. (Currently Amended) A machine-readable storage medium that provides instructions that, if executed by a processor, will cause said processor to perform operations comprising:

establishing different service level topologies for a source node of an wavelength division multiplexing optical network in separate service level topology structures, wherein each separate service level topology references a set of ~~communication~~ paths satisfying the corresponding service level, wherein each of the set of ~~communication~~ paths for that service level references a set of links satisfying that service level on that ~~communication~~ path, wherein the set of links references available wavelengths for that ~~communication~~ path satisfying that service level, wherein a ~~communication~~ path between two access nodes is the set of ~~one~~ two or

more links and available wavelengths on that ~~communication~~ path between the two access nodes, wherein allocated and unallocated wavelengths are considered available wavelengths;

responsive to receiving a request to change a service provisioned with a communication path established in said optical network at one of a plurality of service levels to a different one of said plurality of service levels, selecting a path and a wavelength on said path using a database that stores, the separate service level topology structures, and wherein said service level topology is based on a conversion criteria, and wherein said service topology structure is <u>includes a smaller number of end to end paths</u> ~~smaller~~ than an entire network topology of said optical network;

causing allocation of the selected wavelength in the series of nodes of the selected path to form a new communication path; and

transitioning said service to the new communication path.

65. (Previously Presented) The machine-readable storage medium of claim 64, wherein said communication path is a lightpath.

66. (Previously Presented) The machine-readable storage medium of claim 64, wherein said communication path is an optical circuit.

67. (Previously Presented) The machine-readable storage medium of claim 64, wherein said selecting said path and said allocation is performed in real time.

68. (Cancelled)

69. (Previously Presented) The machine-readable storage medium of claim 64, wherein said database stores, for each of the plurality of service levels, a representation of available conversion free paths from the source node of said communication path to other access nodes in said optical network.

70. (Previously Presented) The machine-readable storage medium of claim 64, wherein said transitioning includes:

moving traffic from the previous communication path to the new communication path; and

deallocating the previous communication path.

71. (Currently Amended) A machine-readable storage medium having stored thereon data comprising:

a service level connectivity database for an access node of a wave division multiplexing optical network, wherein each link of said optical network includes a set of zero or more lamdas for each of a plurality of service levels, each of said plurality of service levels includes a set of zero of more possible end to end paths comprised of a series of ~~one~~ two or more links that include one or more available lamdas of that service level, wherein allocated and unallocated lambda are considered available lambdas, wherein the service level connectivity database includes a separate service level topology structure for each of said plurality of service levels, wherein said separate service topology structure ~~is~~ includes a smaller number of end to end paths ~~smaller~~ than an entire network topology of said optical network, said separate service topology structure is based on a conversion criteria, each of said plurality of service level topology structures storing the data for each of the possible end to end

paths of that service level that end with said access node, said service level connectivity database including,

for each of the possible end to end paths that end with said access node,

data representing,

the series of links of that path; and

the lamdas of that path.

72. (Previously Presented) The machine-readable storage medium of claim 71, further comprising:

a link state database including a link state structure for each node of said optical network adjacent said access node, each of said link state structures including the set of zero lamdas for each of the plurality of service levels.

73. (Cancelled)

74. (Previously Presented) The machine-readable storage medium of claim 71, wherein each of said service level topology structures is a table.

75. (Previously Presented) The machine-readable storage medium of claim 71, wherein each of said service level topology structures is a tree.